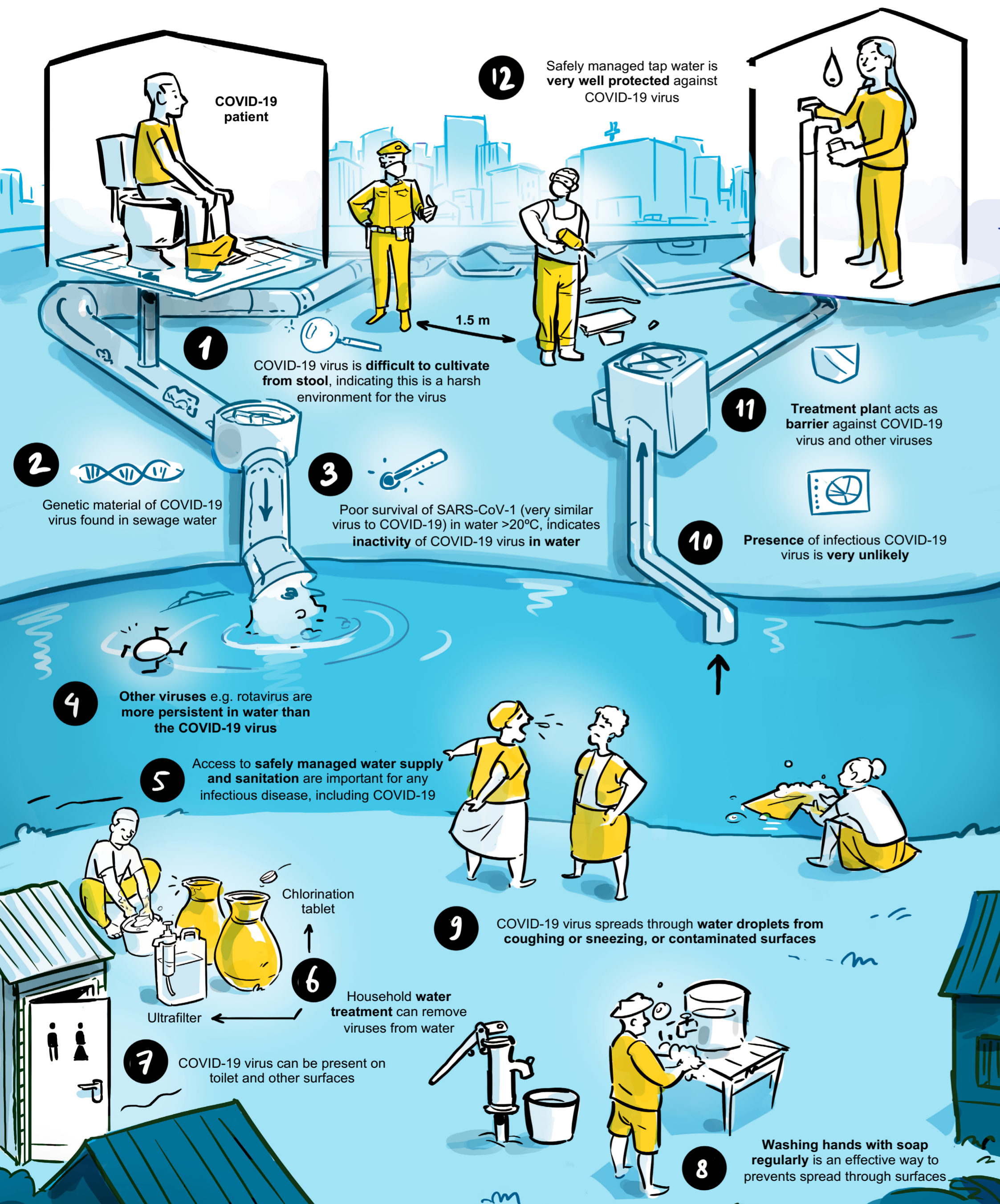


12 FACTS ABOUT COVID-19 VIRUS IN WATER

The importance of water access and hygiene in times of crisis



THE SCIENCE BEHIND THE FACTS

With the COVID-19 virus being a pandemic that reaches all across the globe including in rural communities, many questions arise wondering how the COVID-19 virus relates to water. Is it still safe to use untreated water? Can the virus be present in tap water or rivers? How can I best protect myself from COVID-19? To answer these questions, TU Delft | Global Drinking Water made an easy-to-use overview of 12 scientifically sourced facts about the COVID-19 virus in water. The infographic details the importance of water access and hygiene during this global pandemic, and what behavioural changes people can make to best prevent the spread of the COVID-19 when using water. Find below a summary of resources used for the design of the infographic.

- COVID-19 virus is difficult to cultivate from stool, indicating this is a harsh environment for the virus**
Wölfel et al. (Nature, 2020) found after assessment of hospitalized patients with COVID-19 that the infectious virus was readily isolated from throat- and lung-derived samples. However, in spite of the high virus RNA concentrations found, no infectious COVID-19 virus could be extracted from stool samples.
- Genetic material of COVID-19 virus found in sewage water**
Medema et al. (medRxiv, 2020) were the first to detect genetic material of COVID-19 virus in sewage. During the emergence of COVID-19 in the Netherlands, sewage samples of 7 cities and an airport were tested using RT-PCR against three fragments of the nucleocapsid protein gene (N1-3) and one fragment of the envelope protein gene (E). It is proposed that detection of the virus in sewage can be used as a sensitive surveillance tool to monitor the circulation of the virus in the population.
- Poor survival of SARS-CoV-1 (very similar virus to COVID-19) in water >20°C indicates inactivity of COVID-19 virus in water**
Wang et al. (Journal of Virological Methods, 2005) investigated the survival of coronavirus SARS-CoV-1 at different temperatures in feces, urine and water. SARS-CoV-1 is similar to COVID-19, also called SARS-CoV-2. It was found that SARS-CoV-1 is inactivated faster in wastewater at 20°C (2 days) than at 4°C (14 days).
- Other viruses, e.g. rotavirus, are more persistent in water than the COVID-19 virus**
Raphael et al. (Canadian Journal of Microbiology, 1985) studied the loss of rotavirus infectivity in water, and found that at 20°C it took about 10 days for a 99.0% reduction in the plaque titre of the virus. The authors conclude that rotaviruses can survive for several days in raw and treated river water thus making recreational and potable waters potential vehicles for the transmission of rotavirus infections. Gundy et al. (Food and Environmental Virology, 2008) compared the survival of coronavirus SARS-CoV-1 against the poliovirus. Poliovirus survived longer than coronaviruses in all test waters, except the 4°C tap water.
- Access to safely managed water supply and sanitation are important for any infectious disease including COVID-19**
The World Health Organisation published a **technical brief supplement** specifically to provide guidance on water, sanitation and health care waste which is relevant for viruses (including coronaviruses).
- Household water treatment can remove viruses from water**
The World Health Organisation published **two reports (Round I and II)** on effectiveness of various household water treatment systems for removal of viruses. Many systems showed effectiveness against bacteria and protozoa, but not viruses, so selection of the suitable treatment technology should be done with care. In areas without safely managed centralized water supply, effective household solutions to remove viruses include boiling, chlorination and ultrafiltration.
- COVID-19 virus can be present on toilet and other surfaces**
In a pre-print, Ding et al. (medRxiv, 2020) showed that the toilet area was the most contaminated area in a hospital treating COVID-19 patients. Kampf et al. (Journal of Hospital Infection, 2020) analysed 22 studies which revealed that human corona viruses such as SARS and MERS, or HCoV can persist on inanimate surfaces like metal, glass or plastic for up to 9 days. To efficiently inactivate these viruses within 1 minute, surface disinfection procedures with 62–71% ethanol, 0.5% hydrogen peroxide or 0.1% sodium hypochlorite are recommended.
- Washing hands with soap regularly is an effective way to prevent spread through surfaces**
The World Health Organisation published **guidelines** on hand hygiene in health care. The recommended 2 alcohol-based formulations to be used for outbreak-associated infections were evaluated for their virucidal activity by Siddharta et al. (Journal of Infectious Diseases, 2017). Zika virus (ZIKV), Ebola virus (EBOV), SARS, and MERS could be efficiently inactivated, implicating their use in healthcare systems and viral outbreak situations.
- COVID-19 virus spreads through water droplets from coughing, sneezing or contaminated surfaces**
Chan et al. (The Lancet, 2020) studied six family members after visiting a hospital in Wuhan city, Hubei, China during the COVID-19 outbreak. The authors conclude that their findings are consistent with person-to-person transmission of this novel corona virus in hospital and family settings, and the reports of infected travellers in other geographical regions. Van Doremalen et al. (New England Journal of Medicine, 2020) evaluated the stability of SARS-CoV-2 in aerosols and on various surfaces (including, plastic, copper). SARS-CoV-2 remained viable in aerosols throughout the duration of the 3-hour-experiment. On plastic and stainless steel, viable SARS-CoV-2 was detected up to 72 hours after application, whereas on copper and cardboard no viable virus was detected after 4 and 24 hours, respectively.
- Presence of infectious COVID-19 virus is very unlikely**
Surface water intakes for drinking water production are ideally located upstream of any (waste water) discharges, or at least sufficiently downstream to allow for mixing and die-off of pathogenic micro-organisms. The findings that infectious COVID-19 virus could not be extracted from stool (Wölfel et al., 2020) and that, if present in water, it is likely to be inactivated within days (Wang et al., 2005) leads to the conclusion that it is very unlikely that infectious COVID-19 virus will find its way to drinking water intakes.
- Treatment plant acts as barrier against COVID-19 virus and other viruses**
COVID-19 is a lipid-enveloped RNA virus, and typically more sensitive to disinfectants than other viruses in water (Wang et al., 2005). Water treatment plants are designed to inactivate the most persistent viruses in the water, and are as such effective against the COVID-19 virus. Commonly applied other technologies for virus inactivation are UV irradiation, ozonation and membrane filtration.
- Safely managed tap water is well protected against COVID-19 virus**
The absence of viruses in drinking water is included in the World Health Organisation's **Guidelines for Drinking Water**. Having a Water Safety Plan in place means tap water is safely managed against all viruses, including COVID-19 virus.